devoted to the advancement of science, and pursuing it with energy and discretion, is an example of which we cannot have too many; and the history of Murchison shows how much valuable material may yet be lying dormant in some who have as yet shown no devotion to anything but pleasure and sport.

MARSDEN'S NUMISMATA ORIENTALIA

Marsden's Numismata Orientalia. A New Edition. Part I. "Ancient Indian Weights." By Edward Thomas, F.R.S. (London: Trubner and Co., 1874.)

THIS is the first part of a new edition of "Marsden's Numismata Orientalia," on an enlarged scale, and is the reproduction of an essay published some years ago. As it treats of the earliest information that has come down to us of the system of monetary weights in use amongst ancient Eastern nations, it is considered as an appropriate introduction to subsequent numbers, upon the coins of various Eastern countries, to be contributed by other authors.

Mr. Thomas's essay is a work of considerable interest, not only as regards the information contained in it relating to ancient Indian weights and coins, but also for its philological and ethnological information. The earliest and most important authority cited is from the Sanscrit text of the original code of Hindu law by Manu, the exact date of which is undetermined. Although portions of it are assigned by some authorities between the twelfth and thirteenth centuries B.C., yet the body of the compilation is more generally referred to a period about 400 B.C.

The Indian weights mentioned in the Code of Manu were those of Central India, south of the Himalayas, and comprised between the rivers Indus and Ganges. They were in use after the occupation of this country by the Aryans, whose invasion from the north-west is referred to a period as early as 1600 B.C. Mr. Thomas, however, claims a still earlier origin for this system of ancient Indian weights, and that they were already in use before the Vedic Aryans entered India. The old system appears to have been based on the weight of native seeds. The principal unit was the *Rati*, the seed of the wild liquorice plant. A second unit or standard of weight is stated to have been the *Másha*, a small wild bean, which is also mentioned in the Code of Manu as a food grain. The following tables of monetary weight are taken from the ancient record, and include the smaller seed-grain weights, which, in the original Sanscrit text, are made to originate and lead up to the larger weights in metal, together with the smaller sub-divisions of the seed-grain unit. Their equivalent weight in Troy grains is given by Mr. Thomas as computed from the mean of experimental weighings of the several seeds, and as confirmed from the ascertained weights of less ancient Indian coins.

TABLE I.—*Minor sub-divisions of the Unit, the* Rati.

			Troy grain.
Rati (seed of wild liquorice)			= 1·75
Yava (barley corn husked)	=	⅛ Rati	= 0·5833
Gaura-sarshapa (white mustard seed)	= ⅛ Java	= 1/16 Rati	= 0·0972
Raja-sarshapa (black mustard seed)	= ¼ Gaura	= 1/64 Rati	= 0·0324
Likhya (small poppy seed)	= ⅛ Raja	= 1/512 Rati	= 0·0108
Trasarenu (mote of sunbeam)	= 8 Likhya	= 1/4096 Rati	= 0·00135

TABLE II.—*Multiples of the Unit, the* Rati.

			Troy grain.
Silver.			
Rati			= 1·75
Mashaka (small wild bean)		= 2 Rati	= 3·5
Dharana Purana	= 16 Mashaka	= 32 Rati	= 56·0
Salamana	= 10 Dharana	= 320 Rati	= 560·0
Gold.			
Masha		= 5 Rati	= 8·75
Suvarna	= 16 Masha	= 80 Rati	= 140·0
Pala, or Nishka	= 4 Suvarna	= 320 Rati	= 560·0
Dharana	= 10 Pala	= 3200 Rati	= 5600·0
Copper.			
Karshapara		= 80 Rati	= 140·0

The fanciful introduction of the "very small mote which may be discerned in a sunbeam passing through a lattice" throws doubt on the practical use of this table; but there appears abundant evidence of the continued use of seed-grain weights in India from a very early period.

The earliest record of Indian measures of capacity, which are only incidentally mentioned in Manu, are quoted from a Sanscrit work for which very high antiquity is claimed. It gives the measures of *ghi*, or clarified butter, in equivalent weights of the *masha* and other multiples of the *rati*.

As to Indian measures of length, though permanently based upon natural units, as the digit, span, and cubit, yet the same seed principle is applied in Manu to the small sub-divisions of the digit. Thus, taking the cubit as the unit, the sub-divisions are stated to have been as follows:—

Hosta (cubit).		
Vitasti (span)	= ½	Hosta
Angula (digit)	= 1/12	Vitasti
Yava (very small barley corn)	= 1/24	Angula
Yuka	= 1/96	Yava
Liksha (poppy seed)	= 1/576	Yuka
Balagra (hair's point)	= 1/4608	Liksha
Renu	= 1/36864	Balagra
Transvarenu (mote of sunbeam)	= 1/294912	Renu

The *Hosta*, or cubit, was thus equal to twenty-four digits, or six palms. Mr. Thomas does not assign any particular length to the cubit of *Manu*, but inferentially defines its length from the determined length of the Sikendari *gaz*, or yard, at the end of the fifteenth century, which is rather more than thirty imperial inches. This *gaz* is stated to have been equal to 41·5 digits, and the digit is computed as being equal to 0·72976 inches. This would make the ancient Indian cubit equal to above 17·5 inches.

Mr. Thomas considers that the system of Indian weights here described was indigenous, and he differs from Don V. Queipo, who traces the derivation of the Indian system of weights to primary Egyptian sources. He prefers the "wise reserve of Boeckh," who expresses himself in the following terms:—

"In cases where the weights of measures of different nations are found to be in a precise and definite ratio one to the other—either exactly equal, or exact multiples and parts of each other—we may fairly presume, either that the one has borrowed from each other, or that each has borrowed from some common source. When the ratio is inaccurate or simply approximative, it is to be treated as accidental and undesigned."

The more recent discovery, since the publication of Don V. Queipo's work, of the unit of ancient Egyptian weight, the *Kat* = 140 grains, equivalent in weight to the Indian copper unit, the *Karshapara*, to the gold *Suvarna*, and to one-fourth of the silver *Suvarna*, tends to confirm Don V. Queipo's hypothesis of the identity of the practical units of Egyptian and Indian weights. The Indian

cubit of 17·5 inches, divided into twenty-four digits, is also almost identical with the ancient Egyptian natural cubit of six palms and twenty-four digits. But it appears to be now impossible to determine whether these Indian units were derived from the Egyptian, or both from an earlier common source; although we may fairly assume that this natural cubit was of the same length as that used by Noah before the Deluge. Mr. Thomas's hypothesis of the lesser Indian unit of weight and of length, and of the scale of multiples and parts, is, however, probably correct, as being derived from natural and local sources.

OUR BOOK SHELF

Arboretum et Fleuriste de la Ville de Paris. Description culture et usage des Arbres, Arbrisseaux et des Plantes herbacées et frutescentes de plein air, et de serres, employées dans l'ornementation des Parcs et Jardins. Par A. Alphand. Folio, pp. 110. (Rothschild, Paris.)

ORNAMENTAL gardening, among other things that added to the attractions of the city of pleasure, was greatly fostered during the latter part of the reign of Napoleon III., and does not appear likely to languish under the Republic. The magnificent publication, "Les Promenades de Paris," by the author of the book now before us, is a costly work, known to comparatively few people in this country. We presume that the present volume is regarded as an appendix or supplement to the work named, otherwise we cannot account for the publication of what is little more than a catalogue of names in so unwieldy a form.

An enumeration of the plants grown for the embellishment of the parks and gardens of Paris, in a handy octavo form, would be welcome to almost every lover of horticulture; but the object of the compiler of the "Arboretum et Fleuriste" was doubtless such as we have indicated. It is printed on one side of the paper only, and the matter arranged in columns, giving the names, native countries, soil, use, height, form of leaves, colour of flowers, &c., of the various plants. As a horticultural catalogue the work is fairly well executed, but, like most gardening books, it contains errors that have been copied from book to book, though they were cleared up long ago. In the first part of the work the author has indulged in an attempt to introduce a reform in botanical nomenclature; why it was not carried through we are not told, probably for the reason that, however desirable reformation may be, this one would scarcely receive any support from botanists. It consists in giving all substantive specific names an adjectival form, and, a less justifiable act, of changing the terminations of good Latin names. Thus, for example, *Pinus Coulterii*, *Hartwegii*, and *Fenzlii*, become *P. Coulterea*, *Hartwegea*, &c. Objections might be urged against this course; but why should we change *Benthamiana* and kindred names into *Benthamea?* And *Pinus inopsea* for *P. inops* is quite inadmissible.

The information under the several headings is usually not inaccurate, but somewhat loose. Thus, under the genus *Magnolia*, Pennsylvania is given as the native country of *M. acuminata*, Carolina of *auriculata*, Virginia of *glauca*, and so on; whereas these trees have a much wider range of distribution. Again, under *Cratægus coccinea*, we are told that the specific name indicates scarlet flowers; but the flowers are white, and the fruit scarlet. But as it is not a botanical work, it is scarcely fair to criticise it by a botanical standard, though it is scarcely excusable to give North Africa as the native country of *Calla Æthiopica*, New Zealand of *Caladium esculentum*, &c. *Libocedrus decurrens* is referred to *Thuja gigantea*, and the true *T. gigantea* to *T. Menziesii*; but the synonomy of these plants has long been cleared up even in gardening books.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Prof. Willis's Mechanical Models

THERE is a slight error in your account of the disposition of Prof. Willis with regard to his mechanical models in your last impression (p. 14).

Prof. Willis did not put any price upon his models; but by his will, dated May 11, 1872, directed that his "mechanical models" should be "offered to the University of Cambridge at a price to be fixed by the valuation of some competent appraiser to be nominated and chosen" by his executors.

In consequence, we have caused the models to be so valued, and fixed upon the sum named (1,200*l.*) after due consideration of the means of the University and the requirements of the estate.

A Syndicate was appointed on April 29 to consider whether the whole or a part of the collection shall be purchased. In the event of the University declining to purchase, the portion rejected will be offered for sale by public auction or private contract.

JOHN WILLIS CLARK
W. H. BESANT
Cambridge, May 9 Executors to the late Prof. Willis

Ants and Bees

IN NATURE, vol. xi. p. 306, Mr. Alfred George Renshaw refers to and criticises a paper on "Ants and Bees," lately read by Sir John Lubbock, and assumes, or seems to assume—and the language quoted justifies such assumption—that Sir John advanced the idea that bees have no means of communicating knowledge to each other.

It seems strange to me, who have been all my life familiarly acquainted with the working of bees, that anyone should doubt their power of communicating knowledge. The very idea there advanced, that "if the bees had the means of communicating knowledge, those bees would have told the others in the hive where they could obtain a good store of honey with a very little trouble, and would have brought a lot back with them," I have seen proved and illustrated hundreds of times.

Bee-hunters understand this faculty in the bee perfectly well, and turn it to a good account. Going to a field or wood at a distance from tame bees, with their box of honey, they gather up from the flowers and imprison one or more bees, and after they have become sufficiently gorged, let them out to return to their home with their easily-gotten load. Waiting patiently a longer or shorter time, according to the distance of the bee-tree, the hunter scarcely ever fails to see the bee or bees return, accompanied with other bees, which are in like manner imprisoned, till they in their turn are filled, when one or more are let out at places distant from each other, and the direction in each case in which the bee flies noted, and thus, by a kind of triangulation, the position of the bee-tree proximately ascertained.

Those who have stored honey in their houses understand very well how important it is to prevent a single bee from discovering its location. Such discovery is sure to be followed by a general onslaught from the hive unless all means of access is prevented. It is possible that our American are more intelligent than European bees, but hardly probable; and I certainly shall not ask an Englishman to admit it. Those in America who are in the habit of playing first, second, and third fiddle to Instinct will probably attribute this seeming intelligence to that principle.

It seems to me, and I think it may be so concluded on scientific principle, that there is no difference, except in degree, between the intelligence, or whatever it may be called, of man and of lower animal life. If the honey-bee, the ballooning spider, the agricultural ant, or the dog, is governed wholly by instinct, then it seems reasonable to infer that man is also governed by instinct. If all the actions of lower animal life are automatic, on what principle shall we say that man's are not automatic? If man builds his house, and, intending to furnish it and lay in a stock of provisions, ascertains from his neighbour where he can get the most at the cheapest rate, does he act on any principle different from the bees, who build their house and jointly or separately ascertain where the best stock of honey can be obtained?

In regard to selfishness, I think the bee has the advantage of